Rydberg Constant Encyclopedia Article

Rydberg Constant

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Rydberg Constant

All **matter** radiates electromagnetic **energy** when it is heated. Because each element is different, the radiation it emits under conditions of heating is unique and characteristic of that element. Line emission spectra, produced by heating a very hot gas under pressure, consists of a series of bright lines separated by dark regions. Each of the lines in a spectral series corresponds to a characteristic frequency or wavelength.

Ordinary atomic optical spectra suggest that the motion of the electrons in the outer part of an **atom** depend as much on the interactions between the electrons as on the attractive forces between the electrons and the atomic **nucleus**, both forces being of about the same magnitude. In 1890, the Swedish spectroscopist Johannes Rydberg (1854- 1919) identified a general relationship between the spectra of **hydrogen** and those of many other atoms. This relationship demonstrated the similarity of the spectral lines of elements with larger atomic numbers to the hydrogen spectral series.

Mathematically, Rydberg showed that the spectral terms in different spectral series can be represented by a formula. This formula contains a term which also appears in the mathematical representation predicting the characteristic wavelengths of some lines in the hydrogen spectrum. This common term is known as the Rydberg constant; it's value (for wavelength measured in meters) is $1.097 \times 10^{7}/m$.

Because Rydberg's formula includes a term characteristic of the hydrogen spectra, the formula has been interpreted to mean that the spectra that obey it are representative of the last step of a process by which a neutral atom is built up by capturing and binding electrons to a nucleus, one at a time. That is to say, the force that is required to bind an **electron** to a nucleus shielded by previously bound electrons is very similar to the force experienced by an electron from the nucleus of a hydrogen atom when the electron is the same distance from the nucleus as in the shielded case.